

**IN THE CLAIMS:**

- 1        1. (Amended) An electronic system, comprising a single device having a light emitting portion, and a magnetically sensitive portion, and an energy barrier, wherein said energy barrier is between said magnetically sensitive portion and said light emitting portion, wherein said magnetically sensitive portion is capable of modulating a hot electron current flowing across said energy barrier to said light emitting portion is for modulating light emission from the said light emitting portion.
- 1        2. (Amended) An electronic system, as recited in claim 1, wherein said single device is for converting a magnetic digital signal directly into an optical digital signal.
- 1        3. (Amended) An electronic system, as recited in claim 2, wherein said system single device is for converting said magnetic digital signal to both an electrical digital signal and into said optical digital signal, wherein either or both of said signals can be provided as a device output.
- 1        4. (Original) An electronic system, as recited in claim 1, wherein said magnetically sensitive portion comprises a magnetically permeable material.
- 1        5. (Amended) An electronic system, as recited in claim 1, wherein said single device comprises includes a three-terminal light-emitting transistor, said transistor comprising having an emitter, a base, and a collector, wherein said light is emitted from said collector.

- 1       6. (Amended) An electronic system, as recited in claim 5 2, wherein said base  
2       comprises said magnetically sensitive portion for receiving a digital magnetic control  
3       signal; wherein said magnetically sensitive portion comprises includes a magnetic  
4       switch, wherein switch position is determined by said digital magnetic digital control  
5       signal, wherein a first intensity of light is emitted in a first switch position and a  
6       second intensity of light is emitted in a second switch position, wherein said first  
7       intensity is greater than said second intensity.
  
- 1       7. (Amended) An electronic system, as recited in claim 5, wherein said transistor  
2       comprises ballistic spin filtering to spin polarize and analyze electrons for operation  
3       of said switch.
  
- 1       8. (Original) An electronic system, as recited in claim 7, wherein said transistor  
2       comprises a pair of magnetically permeable layers, wherein when said magnetically  
3       permeable layers are aligned said spin polarized electrons penetrate and when anti-  
4       aligned, said spin polarized electrons are attenuated.
  
- 1       9. (Withdrawn) An electronic system, as recited in claim 8, wherein said magnetically  
2       permeable layers are both located in said base.
  
- 1       10. (Original) An electronic system, as recited in claim 8, wherein one of said pair of  
2       magnetically permeable layers is located in said base and one of said pair of  
3       magnetically permeable layers is located in said emitter.
  
- 1       11. (Original) An electronic system, as recited in claim 5, wherein said emitter is tunnel  
2       coupled to said base across an insulator.

1       12. (Amended) An electronic system, as recited in claim 5, wherein said single device  
2       comprises includes a buried quantum well within a semiconductor collector, wherein  
3       said quantum well is formed of a quantum well material having a lower band gap  
4       than adjacent material.

1       13. (Original) An electronic system, as recited in claim 12, wherein said material having  
2           a lower band gap has a direct transition for more efficient generation of light in said  
3           quantum well.

1 14. (Original) An electronic system, as recited in claim 12, wherein said semiconductor  
2 collector further comprises a Schottky contact region.

1       15. (Original) An electronic system, as recited in claim 14, wherein said semiconductor  
2            collector further comprises an n type Schottky contact region, an undoped quantum  
3            well region, and a p type substrate layer heterostructure.

1       16. (Amended) An electronic system, as recited in claim 12, wherein said light emitted  
2           by said single device comprises photons having an energy approximately equal to the  
3           said band gap of said quantum well material.

1       17. (Amended) An electronic system, as recited in claim 5, wherein said emitter is  
2           capable of providing ballistic electrons across said base to said collector when an  
3           emitter-base bias is provided with a potential exceeding a collector-base said energy  
4           barrier.

1 18. (Amended) An electronic system, as recited in claim 17, wherein said collector-base  
2 energy barrier comprises a base-collector Schottky barrier

- 1 19. (Amended) An electronic system, as recited in claim 5, wherein said single device  
2 comprises a spin valve transistor having a base-collector barrier, a source for  
3 complementary carriers[.] and a place for recombining to generate said photons,  
4 wherein said energy barrier comprises a base-collector energy barrier.

1 20. (Amended) An electronic system, as recited in claim 19, wherein said base-collector  
2 base-collector energy barrier comprises a Schottky barrier, said source for  
3 complementary carriers comprises a p-type substrate layer, and said place for  
4 recombining comprises a quantum well.

1 21. (Withdrawn) An electronic system, as recited in claim 19, wherein said spin valve  
2 transistor includes a base having a first magnetically permeable layer and a second  
3 magnetically permeable layer.

1 22. (Withdrawn) An electronic system, as recited in claim 21, wherein said first  
2 magnetically permeable layer is ferromagnetic.

1 23. (Withdrawn) An electronic system, as recited in claim 21, wherein said second  
2 ferromagnetic magnetically permeable layer has a lower coercive field level than said  
3 first ferromagnetic magnetically permeable layer so said second layer can be  
4 switched without switching said first layer to provide for turning on and turning off  
5 current in said single device with an intermediate level magnetic field.

1 24. (Withdrawn) An electronic system, as recited in claim 23, wherein said spin valve  
2 transistor includes a base-collector contact comprising a Schottky barrier diode  
3 having a Schottky barrier height.

- 1        25. (Withdrawn) An electronic system, as recited in claim 24, wherein said Schottky
- 2                  barrier diode provides that only ballistic electrons having energy at least equal to said
- 3                  Schottky barrier height are injected into said collector.
- 1        26. (Withdrawn) An electronic system, as recited in claim 25, wherein said transistor
- 2                  comprises a variable emitter-base voltage and an independently variable collector-
- 3                  base voltage.
- 1        27. (Withdrawn) An electronic system, as recited in claim 26, wherein said transistor
- 2                  emits photons only when said emitter-base voltage exceeds a threshold
- 3                  approximately equal to the said Schottky barrier height.
- 1        28. (Withdrawn) An electronic system, as recited in claim 26, wherein said transistor
- 2                  emits photons only when said collector-base voltage exceeds a threshold
- 3                  approximately equal to the difference between said bandgap of said collector and
- 4                  said Schottky barrier height.
- 1        29. (Withdrawn) An electronic system, as recited in claim 28, further comprising a first
- 2                  power supply for providing an electrical potential across a collector-base junction of
- 3                  said transistor, wherein when said electrons are injected into said collector over a
- 4                  Schottky barrier with an energy at least equal to energy of said Schottky barrier, the
- 5                  combination of this electron energy and said potential energy provided by said first
- 6                  power supply provides said electrons with enough potential energy to generate
- 7                  photons from recombination in said quantum well.

- 1       30. (Withdrawn) An electronic system, as recited in claim 29, further comprising a
- 2       second power supply for providing an electrical potential across an emitter-base
- 3       junction of said transistor, wherein said emitter provides ballistic electrons at an
- 4       energy exceeding said Schottky barrier when sufficient emitter-base potential is
- 5       provided.
  
- 1       31. (Original) An electronic system, as recited in claim 5, wherein said collector
- 2       comprises an n type region and a p type region and a region-there-between, wherein
- 3       said region-there-between has a lower band gap than either said n type region or said
- 4       p type region so as to trap both electrons and holes for facilitating recombination and
- 5       photon generation.
  
- 1       32. (Original) An electronic system, as recited in claim 31, wherein said region-there-
- 2       between is undoped or lightly doped.
  
- 1       33. (Withdrawn) An electronic system, as recited in claim 5, wherein emitter-base
- 2       contact comprises a second Schottky diode energy barrier.
  
- 1       34. (Withdrawn) An electronic system, as recited in claim 1, wherein said single device
- 2       comprises a two-terminal light-emitting transistor, said two terminal transistor
- 3       comprising a base and a collector, wherein said light is emitted from said collector,
- 4       wherein said base of said two terminal transistor is exposed for receiving sub-band
- 5       gap photons to provide internal photo-emission of charges in said base.
  
- 1       35. (Withdrawn) An electronic system, as recited in claim 1, further comprising wherein
- 2       said single device is included in a magnetic read head, wherein said single device
- 3       that converts magnetic information into an optical signal.

1       36. (Withdrawn) An electronic system, as recited in claim 1, further comprising an array  
2       of said single devices for storing information and for converting said stored  
3       information into optical signals.

1       37. (Withdrawn) An electronic system, as recited in claim 1, wherein said single device  
2       further comprises amplification.

1       38. (Withdrawn) An electronic system, as recited in claim 1, further comprising a power  
2       supply, wherein said single device comprises a collector and a base, wherein said  
3       power supply is connected for providing a collector-base voltage sufficient to  
      provide secondary electrons by impact ionization to provide amplification.

1       39. (Amended) An electronic system, comprising a metal base hot electron metal base  
2       carrier transistor having a metal base, a collector, and an energy barrier, said energy  
3       barrier between said metal base and said collector to block thermalized carriers in  
4       said metal base, said collector having a quantum well for facilitating light emission.

1       40. (Amended) An electronic system, as recited in claim 39, wherein said transistor  
2       comprises a pair of ferromagnetic layers wherein one of said layers can have its  
3       magnetization orientation switched independently of the other layer to facilitate  
4       magnetic switching between a first magnetic switch position and a second magnetic  
5       switch position.

1       41. (Amended) An electronic system, as recited in claim 39 40, wherein a first intensity  
2       of light is emitted in a said first magnetic switch position and a second intensity of  
3       light is emitted in a said second magnetic switch position, wherein said first intensity  
4       of light is greater than said second intensity of light.

1       42. (Withdrawn) An electronic system, as recited in claim 39, wherein said transistor  
2       comprises ballistic spin filtering to spin polarize and analyze said charges carriers for  
3       operation of said switch.

1       43. (Original) An electronic system, as recited in claim 39, wherein said metal base  
2       comprises a ferromagnetic layer.

1       44. (Withdrawn) An electronic system, as recited in claim 43 39, wherein said metal  
2       base comprises a pair of magnetically permeable layers, wherein when said  
3       magnetically permeable layers are aligned said spin polarized charges carriers  
4       penetrate and when anti-aligned, said spin polarized charges carriers are attenuated.

1       45. (Withdrawn) An electronic system, as recited in claim 39, further comprising  
2           wherein said transistor is included in a magnetic read head, wherein said transistor  
3           that converts magnetic information into an optical signal.

1       46. (Withdrawn) An electronic system, as recited in claim 39, further comprising an  
2           array of said devices transistors for storing information and for converting said stored  
3           information into optical signals.

1       47. (Withdrawn) An electronic system, as recited in claim 39, wherein said single device  
2           transistor further comprises amplification.

1       48. (Amended) An electronic system, as recited in claim 39 47, wherein said transistor  
2           comprises a collector, a base, and a power supply for providing a collector-base  
3           voltage sufficient to provide secondary electrons by impact ionization to provide said  
4           amplification.

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- 1        55. (New) An electronic system, comprising a metal base hot carrier transistor having a  
2              metal base and a collector, an energy barrier between said metal base and said  
3              collector to block thermalized carriers, said metal base hot carrier transistor further  
4              comprising a spin filter.
  
- 1        56. (New) An electronic system, as recited in claim 55, wherein said spin filter  
2              comprises ballistic spin filtering to spin polarize and analyze said carriers.
  
- 1        57. (New) An electronic system, as recited in claim 55, wherein said spin filter  
2              comprises a ferromagnetic layer located in said metal base.
  
- 1        58. (New) An electronic system, as recited in claim 55, wherein said metal base  
2              comprises a pair of magnetically permeable layers, wherein when said magnetically  
3              permeable layers are aligned, carriers penetrate and when said magnetically  
4              permeable layers are anti-aligned, said carriers are attenuated.
  
- 1        59. (New) An electronic system, as recited in claim 55, wherein said spin filter includes  
2              a pair of ferromagnetic layers, wherein one of said ferromagnetic layers is capable of  
3              having its magnetization orientation switched independently of the other  
4              ferromagnetic layer to facilitate magnetic switching between a first magnetic switch  
5              position and a second magnetic switch position
  
- 1        60. (New) An electronic system, as recited in claim 59, wherein a first intensity of light  
2              is emitted in said first magnetic switch position and a second intensity of light is  
3              emitted in said second magnetic switch position, wherein said first intensity of light  
4              is greater than said second intensity of light.

- 1        61. (New) An electronic system, as recited in claim 55, wherein said transistor is  
2                  included in a magnetic read head, wherein said transistor converts magnetic  
3                  information into an optical signal.
  
- 1        62. (New) An electronic system, as recited in claim 55, further comprising an array of  
2                  said transistors for storing information and for converting said stored information  
3                  into optical signals.
  
- 1        63. (New) An electronic system, as recited in claim 55, further comprising an optical  
2                  structure, wherein said optical structure is arranged to collect light emitted by said  
3                  light emitting portion.
  
- 1        64. (New) An electronic system, as recited in claim 1, further comprising an optical  
2                  structure, wherein said optical structure is arranged to collect light emitted by said  
3                  light emitting portion.
  
- 1        65. (New) An electronic system, as recited in claim 39, further comprising an optical  
2                  structure, wherein said optical structure is arranged to collect light emitted by said  
3                  quantum well.
  
- 1        66. (New) An electronic system, as recited in claim 39, wherein said transistor further  
2                  comprises amplification.
  
- 1        67. (New) An electronic system, as recited in claim 39, wherein said transistor comprises  
2                  a power supply for providing a collector-base voltage sufficient to provide secondary  
3                  electrons by impact ionization to provide said amplification.